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ABSTRACT

At the University of Twente (Netherlands), a course management system called TeleTOP has been implemented in all faculties. This paper describes the TeleTOP system and the implementation process. In order to find out how teachers use their course environments in education, an analysis was made of 60 course environments. Results showed that these course environments were mainly used for the dissemination of information and less for interactive communication. Also, course environments help students prepare for learning and orientate on course content and practices, but are rarely used for giving feedback, monitoring, and assessment. In the last section of the paper, tips and recommendations are given for improving the use of course environments. (Contains 14 references.) (Author/MES)

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Implementation of a digital learning environment: The real results

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Abstract: At the University of Twente, a course management system called "TeleTOP" has been implemented in all faculties the last 1.5 years. The paper describes the TeleTOP-system and the implementation process. To find out how teachers use their course environments in education, an analysis was made of 60 course environments. Results show, that these course environments are mainly used for the dissemination of information and less for interactive communication. Also, course environments help students prepare for learning, orientate on course content and practice, but are rarely used for giving feedback, monitoring and assessment. In the last section, tips and recommendations are given for improving the use of course environments.

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Introduction

Since the introduction of the world wide web, the web has been used in many ways to support education. The last three years, one particular use of the web has been very popular; the course management system. Different tools or platforms have been developed and implemented in universities all over the world. At the university of Twente, a choice was made for a home-made solution; the TeleTOP system. After successful use in one faculty, the university-wide implementation of TeleTOP started in the summer of 1999. Now, after 1.5 years of hard work, it is time to see what the results are.

In this article, we present the results that can be achieved with the implementation of a course management system in a relatively short period of time. Also, by taking a closer look at the first implementation results we want to research what the "real" results are; to what extent are the implemented course environment really used in education? The third and most important goal of our research is to give examples and guidelines that instructional designers and teachers can use to improve the use of course environments in education.

TeleTOP, the Course Management System of the University of Twente

As said in the introduction, TeleTOP is the course management system of the University of Twente. The goal of this system is to support and facilitate the learning process of students by supplying them with all the information they need to follow a course and with several options for communication with teachers and fellow students through the world wide web. As the University of Twente is a campus-based university, the course management system is used mainly to support on-campus learning.

TeleTOP was developed in the beginning of the year 1998 at the Faculty of Educational Technology (Tielemans & Collis, 1999). The most important demands for the system were, that it should be consistent in terms of lay-out and structure, very easy to work with for both teachers and students, accessible through the WWW without any extra system requirements and based on a database-system. According to these wishes, the development took place at the faculty of Educational Technology. Later in 1998 the Faculty started using the system in its courses.

Because of the successful implementation at the faculty of Educational technology and also because of the lack flexibility in existing systems, the university board decided in 1999 to choose TeleTOP as course management system for the entire university. In the year 2000 the university wide implementation started on a voluntary basis. All technical facilities where supplied by the university and a team of instructional designers was available for educational support, but it was up to the faculties to decide if, and to what extent, they wanted to join the TeleTOP implementation.

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Like most course management systems, TeleTOP is a course based system. For every course, an environment can be created. The teacher can choose which functionalities he or she wants to use for his or her course. Figure 1 gives a schematic representation of the TeleTOP system.

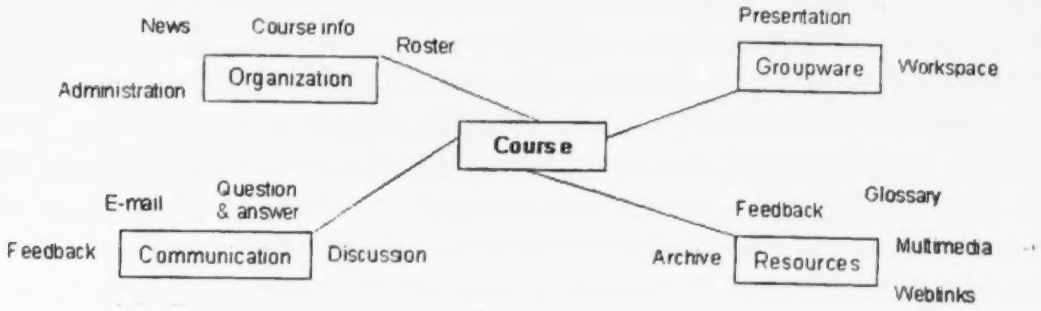

Figure 1: Schematic representation of TeleTOP

The core of every TeleTOP environment is "The Roster" (course schedule). This roster gives the student a very clear overview of the activities and materials in the course. In each TeleTOP site, the roster consists of 3 columns that tell the student what to do *before, during and after a session* (see figure 2. The TeleTOP Roster). By clicking on a link in one of the roster cells, the student is taken to a page were he or she can find more detailed information, study materials and assignments related to that particular activity.

Roster

00	Before the session	Date and location	During the session	After the session	
01	Purchase CD from TDG Secretary	Dec 4 1814 MS	Introduction to Planning and Management	Do exercise attached	
02	Read Unit 3-1, 3-2, 3-3	Dec 5 1845 MS	The Project Cycle		
03	Read Unit 3-1, 3-2, 3-3	Dec 11 1814 MS	The Project Cycle cont		

Figure 2: The TeleTOP Roster

Implementation strategy and results

The way TeleTOP has been implemented at the various faculties differs. In general we can distinguish three strategies used for the implementation of TeleTOP:

1. Overall strategy: TeleTOP is implemented in all study phases of the program and all teachers are expected to use TeleTOP to support their courses;
2. Phased strategy: The implementation starts in the first year of the program. Then, the system is gradually implemented into the other study-phases;
3. Pilot strategy: The faculty starts with a few pilot courses. When the pilots prove to be successful, the implementation is expanded to one of the other strategies.

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The implementation strategy is not prescribed by the university board, but is chosen by the faculty itself. For each faculty an instructional designer of the DINKEL Institute is available for support during the implementation process.

As soon as the faculty board has decided to use TeleTOP in it's education and a choice for an implementation strategy is chosen, a demonstration of TeleTOP is organized for all teachers that will be involved. For the acceptance of TeleTOP by teachers it is proven to be important, that during this introduction, the faculty-director states clearly why and in what way TeleTOP will be used in the Faculty.

After this plenary demonstration, in which a quick overview is given of the TeleTOP system and it's possibilities, individual one-hour appointments are made with the teachers. These appointments can be divided in a technical instruction of TeleTOP and advice about the didactic use of the system. During this appointment the instructional designer and the teacher take a closer look at the course and decide which functionalities of TeleTOP (described in figure 1, §2.1.3) will be most suitable to support the course. After this one-hour introduction, the teacher is able to start filling the course environment with information and materials. For further support during the use of TeleTOP in their course teachers can contact the educational consultant, or take a look at the TeleTOP-supportsite (available on the WWW). This supportsite offers teachers technical as well as didactic tips for the use of TeleTOP in their course.

Right now, after 1.5 years of implementation, more than 400 courses offered at the University of Twente have been implemented into the TeleTOP system. At this moment, all faculties have decided to participate in the TeleTOP implementation process.

The Research

Looking at the sections above, one might conclude, that the implementation of the TeleTOP system has been very successful until now. In one and a half year, more than 400 courses were implemented in TeleTOP and most of the teachers and students at this university are working with the system. However, what really matters is not how many course environments have been created and how many people are involved. If we really want to know how successful the implementation was, we have to look at what is happening inside these course environments to support the learning process. To find out what the real implementation results are, these are the research questions to be answered:

a. For which goal(s) are the course environments used?
b. How do the course environments support the learning processes of the students?

To answer the first research question we identified which of the following three types of interactions were found in course environments;

- Information supply; the teacher supplies the students with information. This can be textual, but also graphical information, video and audio, etc. Information supply can be divided into two sub-categories, namely:
  - *Supply of organizational information*: e.g. the course schedule tells the students when and where the classes take place.
  - *Supply of content-related information*: e.g. in the course environment, the students can find documents in which quantum-mechanics are explained.
- Communication; the teacher communicates with students in an interactive way. This can for example be the answering of questions students send in, discussion statements, etc. Communication can be divided into two sub-categories:
  - *Organizational communication*: e.g. the student asks the teacher when the assessment will take place.
  - *Content-related communication*: e.g. the students have an online discussion about the solution of a math problem.
- Course work; students work on products such as reports, presentation, etc, within the course environment. This last category can be divided into:
  - *Individual course work*; one student works on a product and hands it in individually.
  - *Group-based course work*; students work together as a group on a project, report or something else, supported by the course environment and hand in their product as a group.

The instrument used to answer the second question, is an existing educational model, based on *instructional functions* (Terlouw, 1997). Instructional functions describe which activities should take place in education to ensure that the desired learning processes take place.

The following main functions and sub-functions are defined:

- *Preparatory functions:* motivating, connecting to prerequisite knowledge, giving insight in learning goals, planning the learning process
- *Executive functions:* orientation on knowledge, orientation on skills and attitude, practice
- *Regulative functions:* monitoring progress and effort, feedback during practice, assessment, feedback after assessment

The instructional functions mentioned above give no information about the medium or activity in which these are fulfilled. Within a course, some of these functions will be fulfilled by the teacher (e.g. the teacher gives the students feedback on their work), some by textual materials (e.g. the book lets the student orientate on knowledge), etc. A course management system like TeleTOP in itself cannot fulfill any instructional functions. What we would like to know is which of these instructional functions are fulfilled *through* the TeleTOP course environment, using the environment as a carrier of information and tools.

Because of time constraints, it was not possible to analyze all courses in TeleTOP. For this reason, a selection procedure was made to select 15 % of the existing TeleTOP environments. 10 faculties participated in the research. From each faculty, we selected 6 sites, which brings the total number of analyzed course environments at 60 (= 15% of 400). The course environments were randomly selected on their unique course code.

Results

In table one, we see in the first column the number of course environments (n = 60) in which a certain goal was addressed. In the second column, we see the same data in percentages.

Goal	# of course environments	% of course environments
Supply of organizational information (OI)	60	100.0
Supply of content-related information (CI)	50	83.3
Organizational communication (OC)	15	25.0
Content-related communication (CC)	9	15.0
Individual course work (IW)	25	41.7
Groupbased course work (GW)	12	20.0

Table 1: Goals for using course environments

In table two, we can see how the instructional functions were fulfilled through the 60 analyzed course environments. In column one, we can see, in *what number* of sites the *sub-functions* were found. In column two, in *what percentage* of the 60 analyzed sites *at least one of the sub-functions* was addressed.

Instructional functions	# functions	% sites
Preparatory functions		
Giving insight in learning goals	37x	
Motivating	29x	
Connecting to prerequisite knowledge	15x	
Planning the learning process	12x	
Percentage of sites in which at least one of the preparatory functions was found		*81.67*
Executive functions		
Orientation on knowledge	48x	
Orientation on skills and attitude	19x	
Practicing	37x	
Percentage of sites in which at least one of the executive functions was found		*88.33*

Regulative functions		
Giving guidance / monitoring progress and effort	02x	
Feedback during practice	21x	
Assessment	03x	
Feedback after assessment	01x	
Percentage of sites in which at least one of the regulative functions was found		*20.00*

Table 2: Instructional functions fulfilled through the TeleTOP course environments

Conclusions

Looking at our research questions and the results, we can draw the following conclusions:

For which goal(s) are the course environments used?

In the course environments we analyzed, the emphasis is clearly on the dissemination of information from the teacher to the students. This information is not only organizational but also content-related. In the TeleTOP environments, teachers offer students lecture notes, articles, etc. This matches with the results of the university-wide evaluation of TeleTOP (Peters & Visser, 2001) where students indicate, that the most important benefit of TeleTOP is, that it provides access to information and study materials. In contrast to the first conclusion, not so many course environments are used to support two-way interaction between teachers and students. Content-related communication seems even more difficult to realize. This also corresponds with the results of the TeleTOP evaluation (Peters & Visser, 2001) in which teachers indicate that they do not perceive a functionality like discussion as very useful, because the discussions are seldom content-related and often not very serious. However, with this conclusion, we have to add, that there could be a lot of communication through lectures and e-mail, which is not visible in the TeleTOP environments. Finally, if a course environment is used to support course work, the emphasis is mostly on individual course work and less on group-work.

How do the course environments support the learning processes of the students?

The results show us, that TeleTOP environments are primarily used by teachers to prepare students for learning and helping them to practice and orientate on course content. More attention could be given to helping the students plan their learning and connecting to prerequisite knowledge. Remarkable is, that the amount of guidance, monitoring and feedback is still very poor. Even when students are asked to hand in course work, feedback is not often given through TeleTOP, but face to face or sometimes not at all. Finally, in almost all cases, assessment seems to take place outside of the course environments.

From this research we conclude, that although a lot of activity and dissemination of information is taking place in TeleTOP, some possibilities of the system are not (or not sufficiently) exploited yet. During the first 1.5 years of the TeleTOP implementation, teachers had to put a lot of time and effort in getting to know the system and making their paper-materials available in a digital format. An earlier evaluation study at the Faculty of Educational Technology (Collis & Messing, 2001) shows the same results. Now that this first implementation round has been done, it is time to move to a second round in which the emphasis is on didactics and online interaction. Together with educational consultants, teachers can find ways to come to a better use of their course environments.

Tips and recommendations

In order to elaborate on our conclusions, we conclude with tips and recommendations that teachers and educational designers can use to improve the use of learning environments. Although this research was fully based on the situation at the University of Twente, we feel that the tips and recommendations here could also be used at other educational institutions using a course management system to support their courses.

a. Alternatives for content-related information: content related information in a course environment often exists of lectures, notes or articles. In addition to this, as a teacher, you can:
   - make a link from the course environment to online scientific magazines
   - give a list of relevant, fun and interesting websites students can use while making their assignments
   - show examples of excellent course work from students of previous study-years

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- ask students to search for content-related information and collect this in the course environment

b. To stimulate two-way communication between teacher and students, one can:
   - tell students how often you are going to answer questions that students post in the course environments, so students know when they can expect an answer or reaction
   - ask one student to fulfill the role of moderator in an online discussion or ask a student to actively stimulate the discussion by putting in statements
   - stimulate the use of discussion by putting the first items in yourself and invite students to join
   - stimulate students to ask questions, by putting a few frequently asked questions and answers from last year's group in the course environment

c. The problem with content-related communication often is, that it doesn't occur because it is a separate activity that is not integrated in the course. Some recommendations to stimulate this:
   - The teacher plays an active role in the communication
   - Clear assignments in the course environments tell the students what the topic is and what contribution is expected of them
   - Participation is assessed and rewarded
   - During the face-to-face meetings, the outcomes of the online communications are used in one of the activities

d. There are several ways to motivate students in a course environment:
   - ask students to prepare questions for the next lecture and post them in the course environment
   - give students an active role in the development of the course environment, by making them (as part of a course assignment) deliver content for the site
   - clearly state what intentions you have with the use of the course environment in the course

e. Helping students plan their learning process
   - In the course schedule, instead of only indicating when the lecture are and what assignments have to be made, also indicate how much time a student should spend on each course activity

f. The problem with feedback often is, that it is very time consuming to give written feedback to each student in a course environment. Some alternatives for face-to-face feedback:
   - provide a model-answer, so students can compare their answers to this example
   - use peer review; make students assess each other's work
   - make practice assignments optional; students who really want to practice will make the assignments and receive feedback. Students who feel they don't need the practice can skip the assignments.

Final note: To stimulate teachers to a better use of their course environments, it is essential, that practical tips and recommendations are disseminated into the faculties. Below, we list a few of the many ways to do this:

- Build a support environment in which teachers can find didactic tips and good practice examples.
- Give teachers access to the course environments of their colleagues, so they can see how other teachers fill their course environments and learn from each other's successes and failures.
- Make a list of 'example course environments' available for the whole university on a prominent place and explain to teachers why these are considered 'good examples'.
- Organize didactic workshops where teachers can work on improving their course environments with help of an educational consultant.

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